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EAR DISEASE.

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## IMPORTANCE OF EARLY RECOGNITION OF EAR DISEASE.

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ALTHOUGH the term modern may be with justice applied to almost the whole of our pathological knowledge, it is still more applicable to our acquaintance with the changes produced by diseases in the ear, for before the time of Toynbee (1840-1866) but few attempts had been made to determine anatomically the variations in the tissues which resulted from aural disease. Since that time, however, great progress can be claimed not only in the grosser pathological anatomy, but also in the pathological histology of the tympanum and its conducting apparatus, and this, with our increased appreciation of the physiological functions of the different parts of the ear, and improved methods of examination, gives a basis for the clinical study and treatment of the diseases of that organ which compare favorably with that used for almost any other organ. The cloud of mystery which formerly involved the diseases of the ear is rapidly dissolving, and deafness can no longer be spoken of as a disease, but merely as a symptom capable of explanation from pathological tissue changes which interfere with well-known and well-established physiological and physical laws.

Notwithstanding the very decided advance in our knowledge of the normal and pathological physiology and of the pathological histology of the tympanum, the fact, however, remains that many diseases of the ear and of the tympanum itself, as they are presented to the practitioner, are either

irremediable or capable of but partial improvement, and to some of the reasons for this intractability attention is asked in a general way in this paper.

According to our present knowledge, the tympanum, including the drum membrane, the chain of ossicles, the cavity itself, and the secondary membranes leading to the labyrinth, with their muscular and nervous adjuncts, are the most frequent seat of disease, and the majority of the pathological changes which have been found on dissection as occurring in these parts may be classified under the three heads of hypertrophic, adhesive, and destructive processes. Of hypertrophic and adhesive processes in general it may be said that from their very nature they require time, and usually a long time, for their development; although the same remark is not so strictly applicable to the destructive processes, as it is well established that rapid ulceration and destruction may occur, still, the viability of tissues, and especially of tissues having an important physiological function to perform, like those of the tympanum, is so great that even these may be considered relatively slow, although they take place much more rapidly often, than either of the other two changes. Of all these processes it may be said that they are secondary to some variety of inflammation, and are rather the results of disease than the disease itself. Clinical investigation may fairly claim to have traced these pathological changes to their origin, and to have established the fact in regard to the ear which general pathology has established in regard to such processes in general, namely, that they are the result, as has just been stated, of inflammation in the tissue in which they are found.

All of these inflammations are varieties of inflammation of the mucous membrane of the tympanum, and the majority of them are either serous, mucous, or purulent catarrh of that membrane. The serous variety is characterized by hyperæmia, serous effusion, and oedema of the subepithelial

connective tissue, ending in perfect resolution and absorption, or else in general hypertrophy of the mucous membrane, or in adhesive inflammation, which is a very common result of this disease. In 1013 diseased ears Toynbee found adhesive inflammation in 202, or twenty per cent. The adhesion is brought about in the following way: by a change of position in the tissues, due either to swelling or to collapse of the drum membrane from closure of Eustachian tube, two epithelial surfaces are brought in contact; from the pressure the epithelium is destroyed, and the tissue becomes changed to granulation tissue, and by proliferation from the protuberances adhesion takes place, and the new tissue then undergoes cicatricial contraction. In this way broad or narrow synechiae are formed, which, if they involve the important parts of the conducting mechanism, most seriously impair the hearing. With the general hypertrophy of the mucous membrane the conducting mechanism must be more or less involved, as it is everywhere covered with the mucous membrane.

With the mucous catarrh there is a universal hyperæmia of the mucous membrane, with a serous and cellular infiltration of the subepithelial connective tissue; the epithelium is retained; as the result of hypersecretion of the tubular and racemose glands of the tympanum, there is more or less free mucus mixed with triple phosphates and other crystals in the cavity. This condition is capable of complete retrogression, the membrane returning to its normally delicate and elastic condition; but when it passes into chronic catarrhal inflammation the cellular infiltration becomes organized; the membrane looks bluish-gray or white, is much firmer, stronger, and more vascular, from a varicose condition of the blood-vessels, and we have the thickening which, if it involves the conducting mechanism, very seriously impairs its functions.

The purulent catarrh is characterized by hyperæmia, enor-

mous swelling, and oedema of the mucous membrane, with a secretion of pus cells, granular corpuscles, granules, epithelium, and detritus. The swelling is due to enlargement of the blood-vessels, with cellular and serous infiltration of the connective-tissue stroma; the epithelium is destroyed. The disease is distinctly ulcerative, and may result in great destruction of tissue. It also is capable of complete retrogression, but it may result in hyperplastic processes, forming nodules, villi, and papillary growths; the abundant infiltration of round cells in the middle of the mucosa may become organized, or calcifications may occur. In addition to these tissue changes, irreparable destruction of important parts may take place, or caries or necrosis be produced in the bone.

Besides these pathological conditions from the three varieties of inflammation, still other tissue changes are described by Schwartze, which may result from these inflammations when chronic. In a small proportion of cases there is found a distinct connective-tissue sclerosis of the deep periosteal layer of the mucous membrane, showing tendinous bundles of homogeneous, brittle, opaque fibres in the deeper layer, while the subepithelial connective tissue remains normal. In still a larger proportion of cases the deep periosteal layer is impregnated with finely granular lime salts, and with spots of ossifying periostitis.

The influence of these tissue changes may be understood when it is remembered that the drum membrane, the chain of ossicles, and the secondary membranes constitute the connecting apparatus of the ear, and must necessarily be capable of the most delicate pendulum vibrations. If hypertrophy of the tissues covering this minute apparatus exists, the vibration previously able to cause a certain displacement of the conducting apparatus is no longer capable of producing the same effect; the pendulum adapted to tick half seconds cannot be increased in weight without changing the character

of its work. If adhesive inflammation has occurred, by which new bands and threads of tissues are formed between different portions of this same conducting apparatus, its vibratory power is interfered with. If destruction has taken place, the capability of vibration is much reduced.

Of hypertrophic and adhesive processes it may be said in general that, once thoroughly established, they cannot, as a rule, be removed—that is, if true hypertrophy has occurred and new fibres of tissues have formed, these new fibres remain as a part of the body; if true adhesion has taken place between two surfaces, those surfaces remain adherent. Certain it is that in the tympanum this is the rule; but in this small cavity, when either of these pathological processes occurs upon parts or the whole of the conducting apparatus, there is more to be feared than the simple weighing or binding down of the vibrating pendulum which results from the increased tissue or the adhesive bands. It is a characteristic of both these processes that they very frequently undergo gradual changes after the hypertrophy or adhesion has taken place; that the new tissue and the adhesions become firmer with age, undergoing what may be compared to cicatricial contraction, the result of which in the tympanum is a much greater interference with the vibratory power of the conducting apparatus than would be at first suspected from the mere increase in the tissue growth.

As the advance in our therapeutics has not kept pace with our pathological knowledge in regard to the tympanum (and the same may be said of almost every region of the body), the study of the earlier diseases which produce these tissue changes becomes of the greatest importance; for if the various forms of inflammation which precede and cause these hypertrophies, adhesions, and destructions of the conducting mechanism of the tympanum are as rebellious to treatment as these changes in the tissues are when they have once formed, but comparatively little can be expected, at least at

present, for the relief of many of the pathological conditions of the ear. Fortunately, however, such is not the case; the earlier and more acute forms of tympanic disease are as amenable to treatment as are similar diseases in other organs, and the principles of rational medicine can be as well applied here as elsewhere. Nature herself, in the way she cures innumerable ear-diseases, and without whose aid it is safe to say three fourths of the human race would still be suffering from imperfect tympana, has pointed out a method by which a cure can be effected; and in large numbers of cases where she herself is unable to relieve, assistance from art in the direction she has pointed out in other more fortunate cases is sufficient to restore the parts to their normal condition. To accomplish this, however, it is necessary to watch the course of the disease in its earlier stages, prepared to assist nature by art if necessary, and it is imperatively demanded that such assistance should be rendered before the irremediable tissue changes, already described, have taken place. The natural history of the various forms of tympanic inflammation thus becomes an all-important factor in the study and treatment of these diseases.

Unfortunately, many of the primary inflammations of the tympanum come on so insidiously and with so little inconvenience to the patient that the very slight symptoms which exist are ignored or soon forgotten, from the patient becoming accustomed to them, and it is only months or years even afterwards, when the tissue changes have made considerable progress and the interference with the functions of the ear has become so great as to produce inconvenience in the ordinary affairs of life, that relief is sought.

This ignoring of the earlier symptoms of tympanic disease, and the consequent neglect of treatment at the time when it could be of value, is one of the most prolific causes for the numerous unfavorable prognoses which must be given when the sufferer applies for relief. Not infrequently it happens

that the patient denies absolutely that any symptoms have preceded the existing deafness, but in so many cases close questioning will develop the existence of this or that symptom, often so long before as to have been forgotten entirely, that it seems probable that in almost all cases there were originally some antecedent warnings. The following could be taken as a very common example: the patient gives a history of gradual deafness, without subjective noises, of six months' duration, and denies absolutely any preceding disease in the ears. Examination shows a drum membrane generally opaque from thickening in its mucous layer, very considerably retracted and immovable, the Eustachian tube closed tightly. Inquiry elicits the fact that three years before he does remember that, with a very severe cold, the ears felt tight and full, and there were for a time violent subjective noises which ceased gradually; that he regarded it as "nothing but a cold;" now that you ask him, however, he remembers this or that circumstance when he suspected a little deafness much longer ago than he had at first stated. The facts evidently are that three years before, with an acute catarrhal inflammation of the naso-pharynx, the mucous membrane of the Eustachian tubes and tympanum was also inflamed; the trouble of the naso-pharynx passed off, but the mucous membrane of the tympanum remained congested and swollen; as the result of this continuous inflammation hypertrophy of the membrane has occurred and increased, till it has most seriously impaired the hearing.

Or, again, another very common history is that the patient has been subject to slight deafness with each cold in the head for a number of years, till finally the deafness has become so marked as to be a serious inconvenience. Then, and not till then, relief is sought, and examination showing very decided tissue changes, the prognosis is necessarily much less favorable than it would have been in the preliminary

stages of inflammation. In children it frequently occurs that examination shows the drum membrane completely collapsed against the inner tympanic wall, and firmly adherent to this wall, so that it cannot be separated; or else it is retained in its abnormal position by inflammatory retraction of the tensor tympani muscle and of the hypertrophied tissues, a condition originally produced by closure of the Eustachian tube, and which would in all probability have been removed by any of the simple methods of opening that tube, or even by a little judicious blowing of the nose, which, by relieving the obstruction of the blood-vessels and the consequent congestion, would have allowed nature to clear up the pathological products and would have restored the parts to their natural condition.

Another very common reason for ignoring the earlier symptoms of tympanic disease, even when they are very marked or possibly severe, is the slight improvement which often occurs spontaneously after a time, and which leads the patient to think that all trouble has been averted,—an improvement which is quite often fallacious in that it deceives the patient into a sense of perfect security, whereas it is simply a transition from the acute into the chronic inflammation. Such an improvement is seen often with acute catarrhs of the tympanum: the subjective noises and the pain cease after a time; the sense of fulness in the ear the patient becomes accustomed to, and it is forgotten; the obstruction of the Eustachian tube with the congestion and swelling of the tympanic mucous membrane, however, remain, and gradually produce the hypertrophy which months or even years after leads the patient to apply for relief from what has become, with the lapse of time, an incurable deafness.

Instances might be multiplied almost indefinitely of simple and remediable diseases becoming hopeless from these changes in the tissues, which have come on gradually as the result of preceding inflammation.

That the interference with the functions of the ear, the deafness, which appears as a rule gradually as the tissues become hardened and retracted, is not more frequently recognized in its incipiency can only be referred to a want of appreciation of what deafness is. Nothing is more common than to hear a patient or his friends say that he is not deaf, because he can hear what is said to him across a moderately sized room; they being apparently wholly ignorant of the fact that deafness consists in the inability to hear a sound of a given intensity or loudness at as great a distance as normal, and that, although he may hear a loud voice at a distance of twenty feet, he should, in a normal condition, hear the same voice at one hundred feet, in reality four fifths of his hearing for that particular sound being lost. The extreme limit of hearing power is but seldom used in the ordinary affairs of life, and as far as our daily business life is concerned we may each be said to be endowed with a large amount of superfluous hearing, which may be lost with scarcely any inconvenience to ourselves.

Again, the merciful provision of nature, which has endowed each of us with two independent organs of hearing, is often lost sight of in estimating degrees of deafness, it being forgotten that a person may be very deaf with one ear, and yet hear so perfectly with the other that the defect is not noticed. Indeed, the records of the consulting room show large numbers of cases where increasing trouble in the good ear is the cause of the patient first applying to the physician; and he is astonished, and often incredulous, at being informed that one ear has evidently been practically useless for a long time, and that the inconvenience he has been experiencing is due to more recent disease in the other ear.

It will be asked, What is the remedy for all this? How are these very serious results to be guarded against? The only answer is that, as the histological changes are, in the

majority of cases, irremediable in themselves, and as they are secondary to and the direct result of other diseases, the primary disease, for which treatment is often of great value, requires very careful attention. Symptoms, however slight, should not be neglected; the natural course of the disease, whatever its variety, should be understood, and its course watched; if necessary, local or general treatment should be used to assist nature; and, finally, the case should remain under observation till recovery is perfect, or as nearly so as the particular disease will admit. This latter point, the insurance of perfect recovery, is all-important, for a little remaining disease may be sufficient to produce the hypertrophy of the mucous membrane, which will go on insidiously for a long time before it is noticed by the patient.

To recognize and fully appreciate all of the minute changes which can be seen by the otoscope is undoubtedly a task requiring much time and practice; but the clinical histories and rational signs of the various diseases are well described in the numerous books on the ear; and in the tests of the hearing we have a very useful means, although not infallible, of judging how the disease is progressing. If more attention was paid to the degree of deafness, or perhaps it would be better to say of hearing, in the earlier stages of tympanic disease, there would be much less of the incurable secondary processes. By occasional careful testing, the gradual loss of hearing would be noticed almost as soon as it began, and the improvement which often follows well-marked acute disease would be by this means early discovered to be merely fallacious. The importance and the methods of applying simple tests for the hearing should be known to every practitioner. I have already called attention to the fact that a person may be extremely deaf in one ear, and yet with the remaining good ear hear so well that no defect is noticed; but I have known physicians themselves to say of such a case that they did not believe there could be any deafness,

simply because they had never tested the hearing of the two ears separately. It would seem superfluous to notice, but experience shows, that the failure to close one ear when testing the other, is a very common source of error. The first step in testing, then, should be the closure of the opposite ear with one finger.

Having done this, the open ear should be tested for the distance at which both the watch and the voice can be heard; not whether they can be heard at all, but whether they can be distinguished as far as normal. In regard to the watch, it should be remembered that the intensity of the ticking varies in different watches, and for comparative tests the same watch should always be used, and the normal distance established by tests on normal ears. It should also be borne in mind that the normal hearing distance for the ticking of a watch varies with age, being very much less in old persons than in children. With the voice the hearing distance should be established in the same way; but as it is generally impossible to get space enough to thoroughly test a clear, distinct tone, that is, as it is impossible, for want of space, to reach anything like the normal distance for that tone in ordinary houses, it is necessary to lower the intensity of the tone to make the normal hearing distance for that tone correspond, approximately at least, with the size of the room in which the test is made. Having done this, words or short sentences should be used, and the patient required to repeat them; for if this repetition is not insisted upon, many patients will assert positively that they understood, when they have merely heard the sound of the voice, but have been wholly unable to distinguish the words. It is also well to use a number of different words or sentences, as certain letters of the alphabet have much less distinctive sounds and are much less readily heard than others. If this caution of employing several sentences is used, how-

ever, it can scarcely occur that in each of them these difficult letters and sounds should predominate.

Having determined the distance at which both voice and watch can be actually heard, and knowing the distance at which they should be normally heard, the hearing for that case can be well expressed for practical purposes as a fraction, the numerator of which is the actual distance, and the denominator the normal distance. The necessity of testing for both watch and voice depends upon the fact that the hearing for the two is by no means always proportionally the same; while it may be very good for one, it may be very bad for the other. This is seen especially in the class of cases where the degree of hearing enables us to judge very fairly how the case is progressing, and whether any treatment for the restoration of the functions of the ear is absolutely necessary; these cases are those of acute tympanic inflammation, where, as the inflammation subsides, the hearing slowly returns, but much more rapidly, as a rule, for the voice than for the watch, so that it is found when the hearing for the watch is only perhaps  $\frac{1}{6}$ , that for the voice will be  $\frac{1}{3}$ .

In children the test for the watch is often uncertain, from fright, mischievousness, or lack of intelligence on the part of the patient, but that for the voice can generally be made effectual by a little ingenuity on the part of the physician in asking questions on subjects in which the child takes an interest, the answers to which will show that the question was well understood.

In all testing great care should be taken to exclude the imagination, which is not infrequently both active and ingenious in deaf persons. If such tests were in common use, it would often be found that the cessation of pain, discharge, and other well-marked symptoms did not necessarily imply a restoration of the ear to its normal condition; any deafness would be by this means discovered early, long before it

had begun to inconvenience the patient, and the question of treatment could be determined before the serious and irremediable tissue changes had come on, at a time when treatment is, in a large number of cases, of real positive value.





